PRODUCTION OF LENGTHY CORUNDUM PIPE

V. A. Bezlepkin¹

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Studies on ways of obtaining lengthy corundum pipe are discussed. The technical characteristics of the articles that have been produced are presented.

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Purely corundum articles in the form of pipes or jackets for thermocouples are widely used in modern technology. Nevertheless, the question of fabricating thin-walled (from 2 to 4 mm) lengthy (from 1000 to 1500 mm) corundum pipe with sag not greater than 0.2 mm per meter of length is still a question of definite importance. A number of different methods of molding such pipe are known, above all, the traditional method of extrusion, then vibratory casting, quasi-isostatic, gas-flame, and detonation methods. The method of quasi-isostatic molding is currently the most common, though it requires the use of expensive water gauges.

The present goal has been achieved at OAO Polikor through the use of the method of plasma-jet spraying, which simultaneously combines two technological operations – molding and sintering. In a number of cases, therefore, articles that have been produced by means of plasma-jet spraying according to the “casting skin” technology may be used without any additional treatment. However, if the customer requires articles with low porosity, in such cases the articles must be subjected to additional roasting either in an air atmosphere or in a vacuum. The conditions of molding of pipe are selected on an UPU-8M plasmotron. Corundum powder with dimensions of the granules from 20 to 120 μm are selected as the initial material. By spraying powders of three fractions (20 – 60, 60 – 100, and 60 – 120 μm), we were able to establish that the 60 – 100 μm fraction is the optimal fraction from the point of view of density of the billet produced. The dependence of the porosity of the billet on the dimension of the corundum fraction is presented in the accompanying chart.

Corundum fraction, μm	20 – 60	60 – 100	60 – 120
Open porosity, %	16.1 $\pm$ 0.2	13.2 $\pm$ 0.2	17.6 $\pm$ 0.2

Fig. 1.

Next, billets that have been produced by spraying of a 60 – 100 μm corundum fraction are roasted in open air for the purpose of selecting a temperature for the production of articles with given porosity. The dependence of the porosity of the articles on roasting temperature is shown in the accompanying chart.

Roasting temperature, $^{\circ}\text{C}$	1580	1650	1730
Open porosity, %	12.5 $\pm$ 0.2	11.3 $\pm$ 0.2	7.5 $\pm$ 0.2

Corundum jackets measuring 40 $\times$ 32 $\times$ 1000 mm (cf. Fig. 1) and possessing the following characteristics have been fabricated at OAO Polikor on the basis of these results: content of basic substance, greater than 99%; open porosity, 12.0%; sag, 0.2 mm. The latter characteristic could be achieved due to 1.5% shrinkage of the article following roasting at 1650 $^{\circ}\text{C}$. On the basis of the experience gained at OAO Polikor the recommended working temperature of such jackets must not exceed 1750 $^{\circ}\text{C}$ both in open air and in a vacuum.

The new technology is now being used at the enterprise for small-lot production of pipe and jackets. Full-scale production will become feasible once the demand for these articles grows on the market.

¹ OAO Polikor, Kineshma, Russia.